

A B S T R A C T

An n-type InP sub collector layer 2 heavily doped with silicon (Si), an InP collector layer 3, a p-type $\text{GaAs}_{(0.51)}\text{Sb}_{(0.49)}$ base layer 4 heavily doped with carbon (C), an n-type $\text{In}_{(1-y)}\text{Al}_{(y)}\text{P}$ emitter layer 7 doped 5 with Si, an n-type InP cap layer 8 heavily doped with Si, and an n-type $\text{In}_{(0.53)}\text{Ga}_{(0.47)}\text{As}$ contact layer 9 heavily doped with Si are stacked on a substrate 1.